THE VEGETATION AND FLORA OF GLACIATED PRAIRIE POTHOLES ON THE BLACKFEET INDIAN RESERVATION, MONTANA

FINAL REPORT

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INTRODUCTION

A significant number of small wetlands, primarily marshes and ponds, are found in the glaciated prairie region of central North America (Mitsch and Gosselink 1986). Pothole topography occurs in areas that were covered with glacial drift deposits during the middle advances of the Wisconsin glaciation. Glaciated pothole prairie is well represented in southern Alberta, southern Saskatchewan, extreme southwestern Manitoba, northeastern and north-central Montana, northern and east-central North Dakota, eastern South Dakota and small portions of western Minnesota and northwestern Iowa (Stewart and Kantrud 1971). This region, because of its numerous ponds, small lakes and marshes and fertile uplands, is described as being one of the most important wetland regions in the world (Weller 1981). It provides migration and breeding habitat for numerous species of birds, including 60-70% of the total continental duck production in North America (Redelfs 1983). One half of the prairie potholes in the United States were drained by 1950, and 48,000 acres of prairie wetlands are currently being lost annually (Redelfs 1983). In much of the area where prairie wetlands remain intact, the grassland surrounding them has been plowed for farmland or seriously degraded by livestock grazing (Lesica, personal observation; Bonnie Heidel, North Dakota Natural Heritage Program, personal communication).

Although Montana is on the periphery of the glaciated prairie pothole region, there are five significant areas of the state where this ecosystem occurs (Lesica 1987). One of these areas is on the western edge of the plains, just east of the Lewis Range and Front Range of the Rocky Mountains in Glacier and Pondera counties. Most of this prairie-wetland area is on the Blackfeet Indian Reservation. Prairie wetlands on the Blackfeet Reservation have been little explored botanically. I know of no previously published accounts of the wetland vegetation or flora for this region.

The purpose of this study is to describe the vegetation and flora of the prairie pothole wetlands on the Blackfeet Indian Reservation. In addition, I have used the information obtained to set conservation priorities aimed at protecting the biological diversity of this important wetland region.

THE STUDY AREA

My study focused on eight prairie-wetland complexes in the western and northern portions of the Blackfeet Indian Reservation in Glacier and Pondera counties, Montana (Fig 1). I identified these as areas of high wetland density and native grasslands from aerial photographs and USGS quad maps. These areas are described in detail in the Results section. Two additional areas, Kennedy

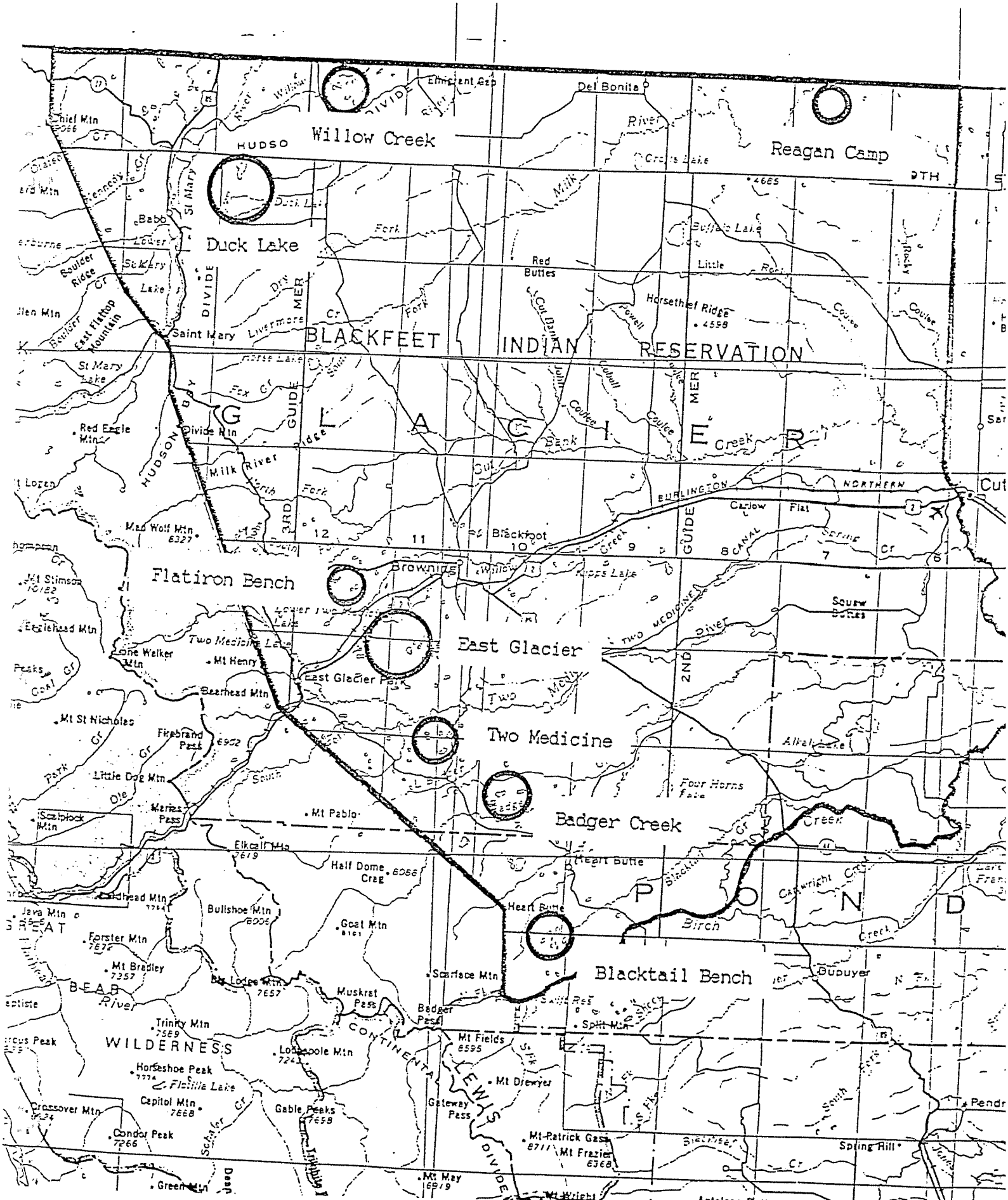

Figure 1. Location of prairie-wetland study areas on the Blackfeet Indian Reservation

Creek (T37N R14W) and Milk River (T37N R8W) also have high wetland density but were not visited. In the former, most prairie has been converted to cropland, and I was denied access to the latter. The climate of this region is continental with the exception that the western portion receives heavy winter snowfall. Mean January minimum and July maximum temperatures at Cut Bank are 4.2 and 78.9 F respectively. Mean annual precipitation is 12.0 in. Mean January minimum and July maximum temperatures at Browning are 7.1 F and 77.2 F respectively. Mean annual precipitation is 15.5 inches, and mean annual snowfall is 66 inches. Mean annual snowfall at East Glacier 20 miles further west is 205 inches (NOAA 1982,USDA-SCS 1980). Predominant vegetation in the study area is foothills prairie and mid-grass prairie (Weaver 1980). The western edge of the study area is aspen parkland, a mosaic of aspen forest and foothills prairie (Lynch 1955).

METHODS

Field work was conducted on July 18-22, 1988 and July 6-10, 1989. Within the study area, I characterized the vegetation around each of 6-17 ponds in each prairie-wetland complex. I attempted to sample ponds throughout each area in order to obtain a complete representation of wetland plant associations. After surveying the vegetation around a pond, I recorded all vascular plant species with an estimated canopy cover of greater than 5% in stands that represented the wetland vegetation zones present. I also recorded all wetland plant species observed in each pond complex except in the Two Medicine area.

Wetland vegetation zones were defined using a system similar to that developed by Stewart and Kantrud (1971) to characterize wetlands in the glaciated region of North Dakota. The zones are:

1. Open Water - flooded throughout the growing season, usually with greater than 2 ft. of water. Dominant plants are submergents or floating-leaved species.

2. Marsh - flooded throughout most of the growing season but sometimes drying by late in the summer. Dominant plants are emergent graminoids. Floating-leaved species are also common.

3. Drawdown - flooded during the spring but drying by early summer. Dominant plants are forbs and graminoids.

4. Wet Meadow - generally not flooded, but proximity to the pond basin provides an elevated water table compared to adjacent grasslands. Dominant plants are graminoids.

These zones reflect differences in the length of time that plants endure flooded conditions. Differences in water regime have been shown to be important in determining wetland species composition (Walker and Coupland 1968, 1970).

Differences in species composition of wetland communities are also often correlated with differences in the salinity of pond water (Stewart and Kantrud 1971, Walker and Coupland 1968, 1970)). In order to quantify dissolved solids, I measured specific conductance of the water in each pond with a portable, temperature-compensated conductivity meter. Salinity of pond waters is classified using the following system (Stewart and Kantrud 1971):

Fresh	0-500 uhmos/cm
Slightly brackish	500-2000 uhmos/cm
Moderately brackish	2000-5000 uhmos/cm
Brackish	5000-15000 uhmos/cm
Saline	15000-100000 uhmos/cm

The amount of dissolved solids varies with the amount of precipitation and runoff recharge (Stewart and Kantrud 1971). 1988 was a drought year; thus, conductivity measurements were probably somewhat higher than would have been obtained in a year of average precipitation.

For each pond I classified the substrate into one of three types: mud, stony and organic or a combination of two of these descriptors (e.g. organic mud, stony mud etc.). Stony substrates had large amounts of gravel or stones and were relatively firm. Mud substrates were composed primarily of fine-textured mineral sediments. Organic substrates appeared to have large quantities of fine- to coarse-textured organic material recognized by its dark color and lower specific gravity.

I collected dominant species data for 255 stands associated with 84 ponds. Stands were grouped into plant associations by tabular comparison (Mueller-Dombois and Ellenberg 1974). Delineation of species assemblages into plant associations was subjective, and it should be remembered that classification of vegetation into communities or plant associations is usually an artifact imposed on the real world by the classifier. Wetlands, in particular, seem to present an array of species assemblages that defy satisfactory classification (Raup 1975). Many of the plant associations described below occur adjacent to each other and merge together over a broad area. In some cases it was difficult to place a stand of vegetation into a single plant association.

The location of ponds sampled and conductivity measurements of pond waters is presented in Appendix A. Exact locations are

delineated on USGS topographic maps on file at the Field Office of the Nature Conservancy in Helena, Montana.

A list of wetland plant species (species that obtain their greatest representation in wetlands) observed in association with prairie ponds in the study area is presented in Appendix B. Nomenclature follows Hitchcock and Cronquist (1973). Since the study was conducted during mid-summer, early-blooming species may not have been recorded. Calamagrostis inexpansa and C. neglecta cannot be easily separated in the field and have been combined under the former name. Puccinellia nuttalliana and P. distans are also difficult to distinguish from each other (Great Plains Flora Association 1986); consequently, in the plant association descriptions I have used just the generic name. Polygonum amphibium and P. coccineum are now considered conspecific and have both been included under the former name (Hickman 1984). Scirpus validus is relatively rare in the study area, and I have treated it as an ecological equivalent of S. acutus.

RESULTS AND DISCUSSION

Description of the Vegetation

Open Water Zone

These plant associations occur in the central, permanently flooded areas of many of the larger and deeper ponds. Plants occupying this zone are rooted or free-floating submergents. Species richness appears to be controlled mainly by the salinity of the waters.

Potamogeton richardsonii/Myriophyllum spicatum Association. Ponds with fresh to slightly brackish waters frequently support aquatic communities dominated by Richardson's pondweed (Potamogeton richardsonii), fennel-leaved pondweed (P. pectinatus) and water milfoil (Myriophyllum spicatum). Although the latter two species occur in more saline waters, Richardson's pondweed appears to be confined to waters with relatively low conductivity. Conductivity measurements ranged from 230 to 2,300 uhmos/cm with a median of 460 uhmos/cm. Substrates ranged from mud to stony organic. Other common species include water crowfoot (Ranunculus aquatilis), grass-leaved pondweed (Potamogeton gramineus), water smartweed (Polygonum amphibium) and common bladderwort (Utricularia vulgaris). Ponds at the brackish end of the range have fewer species. Many of the aquatic species occurring in this zone are also found in adjacent marsh associations. This association occurs throughout the study area.
(Ponds 10,11,14,15,16,17,18,26,34,39,40,41,43,45,68,69,75,76,80)

Potamogeton pectinatus/Myriophyllum spicatum Association. As the salt concentration of the waters increases, species richness declines. Ponds with slightly brackish to saline waters are most frequently dominated by fennel-leaved pondweed and water milfoil. At the more brackish end of the range, only fennel-leaved pondweed is present. Conductivity measurements ranged from 270 to 43,900 uhmos/cm with a median of 2,500 uhmos/cm. Substrates were mud, stony or organic. This association occurs throughout the study area.
(Ponds 3,5,9,13,19,29,33,35,36,37,53,72,79)

Ruppia maritima/Potamogeton pectinatus Association. In the Badger Creek and Two Medicine areas, ponds with moderately brackish to saline waters and stony substrates support aquatic communities dominated by ditch-grass (Ruppia maritima) often associated with fennel-leaved pondweed. Conductivity measurements ranged from 2030 to 42,800 uhmos/cm with a median of 7,700 uhmos/cm. (Ponds 20,21,22,23,24,30)

Zannichellia palustris Association. In the northeastern end of the study area, ponds with slightly brackish to brackish waters and mud bottoms have aquatic communities dominated by horned pondweed (Zannichellia palustris). Fennel-leaved pondweed is an occasional associated species. Conductivity measurements ranged from 945 to 15,710 uhmos/cm with a median of 3,745 uhmos/cm. (Ponds 49,54,55,60,62)

Marsh Zone

Marsh vegetation occupies the center of some temporary ponds or, more often, occurs around the margin of the open water zone. Areas supporting marsh vegetation are flooded during most of the growing season and occasionally for the entire year. Often more than one marsh association will occur in the same pond, usually in response to depth gradients. Thus, areas of different marsh vegetation may form concentric rings around open water, or different communities may occupy areas where the basin slope is different. Substrate texture and salinity of the water also play a role in determining the composition of marsh vegetation. The line between marsh and drawdown zones is not always clear. The two zones share many common species, and communities such as the Carex atherodes/Eleocharis palustris Association might just as easily be described as drawdown vegetation. In the study area, marsh vegetation is common only around ponds with fresh to moderately brackish waters. Marsh vegetation associated with Pond 35, 53 and 60 could not be classified into one of the associations presented below.

Scirpus acutus Association. Vegetation dominated by hardstem bulrush (Scirpus acutus) commonly occupies deeper areas of the marsh zone. Bulrush is often the only emergent species; however,

common spikerush (Eleocharis palustris), mare's-tail (Hippuris vulgaris) and cattail (Typha latifolia) may also be present. Common submergent and floating-leaved species are water smartweed (Polygonum amphibium), needle spikerush (Eleocharis acicularis) and common bladderwort (Utricularia vulgaris). This association occurs in ponds with fresh to moderately brackish water. Conductivity measurements ranged from 270 to 5,560 uhmos/cm with a median of 780 uhmos/cm. Substrates were muddy or organic. This association is usually bordered on the deep edge by the open water zone and along the shallow margin by other marsh associations or drawdown zone vegetation. It is common throughout the study area.
(Ponds 3,4,5,11,12,15,17,19,22,26,27,37,39,40,42,53,55,56, 57,60,64,66,72,76)

Glyceria borealis/Eleocharis palustris. Northern mannagrass is a major component of marsh vegetation in the foothills areas. In most cases this association occurs in ponds with fresh water. Conductivity readings ranged from 215 to 1,660 uhmos/cm with a median of 355 uhmos/cm. Substrates were muddy or, more often, organic. Common associated species include the emergents common spikerush, water foxtail (Alopecurus aequalis) and mare's-tail and the submergent and floating-leaved species Richardson's pondweed (Potamogeton richardsonii), grass-leaved pondweed (P. gramineus), water crowfoot (Ranunculus aquatilis), needle spikerush and water smartweed. This association is bordered on the deep margin by open water or the Scirpus acutus Association and on the shallow margin by the drawdown zone or shallow marsh vegetation. Occasional stands with beaked sedge (Carex rostrata) are intermediate between this and the following type.
(Ponds 15,17,38,41,43,68,69,70,71,73,74,77,75,76,80,81,82,83)

Carex rostrata/Eleocharis palustris Association. Marsh vegetation dominated by beaked sedge occurs in areas close to the mountains. Other common emergent species include common spikerush, water-parsnip (Sium suave), Baltic rush (Juncus balticus), giant mannagrass (Glyceria grandis) and mare's-tail. Two common floating-leaved species are water smartweed and grass-leaved pondweed. This association occurs in ponds with fresh or slightly brackish water and organic substrates. Conductivity measurements ranged from 215 to 1,660 uhmos/cm with a median of 415 uhmos/cm. This association is bordered on the deep margin by open water or the Scirpus acutus Association and on the shallow margin by the drawdown zone or shallow marsh vegetation. It is similar to the Glyceria borealis/Eleocharis palustris Association, but is usually occurs in more shallow water. (Ponds 7,36,37,38,43,73,74,75,77,78,79,80,81,82)

Carex atherodes/Eleocharis palustris Association. Shallow marsh vegetation dominated by awned sedge (Carex atherodes) is common in the Willow Creek area. Common emergents are common spikerush, squirreltail barley (Hordeum jubatum), alkaligrass

(Puccinellia spp.) and water parsnip. Common submergent and floating-leaved species are fennel-leaved pondweed (Potamogeton pectinatus) and water smartweed. This association occurs in ponds with fresh to moderately brackish water and mud or, more often, organic substrates. Conductivity measurements ranged from 150 to 5560 uhmos/cm with a median of 585 uhmos/cm. This association often is found where drying occurs relatively early in the season. (Ponds 28,56,57,60,63,64,65,66,67,70,84)

Eleocharis palustris/Eleocharis acicularis Association. The only common large emergent species in this shallow marsh community is common spikerush. Less common emergents are mare's-tail and water parsnip. Common submergents and floating-leaved species are needle spikerush, grass-leaved pondweed, water crowfoot, common bladderwort and water smartweed. This association occurs in ponds with fresh to moderately brackish water and mud or organic substrates. Conductivity measurements ranged from 150 to 2,500 uhmos/cm with a median of 435 uhmos/cm. This community borders other marsh associations or open water on the deep margin and the drawdown zone along the shallow margin. This association is common throughout the northern part of the study area.
(Ponds 7,10,17,35,36,37,38,45,47,48,50,63,78,79,81,84)

Drawdown Zone

Vegetation in this zone tends to be sparse around permanent ponds and more dense in temporary ponds. Mud substrates generally support denser vegetation than stony substrates. This zone is inundated during the early part of the growing season, but is generally dry by late spring or early summer. In ponds with permanent fresh to moderately brackish water, drawdown vegetation most often occupies a position between marsh and meadow vegetation. In ponds with moderately brackish to saline waters, the drawdown zone frequently occupies a position directly adjacent to open water. In temporary ponds drawdown zone vegetation may occur throughout the entire pond depression. Substrate and salinity of the water appear to play an important role in determining the composition of vegetation in this zone. Steepness of the pond basin may also be an important factor. Stands in this zone present a bewildering array of species assemblages, and distinct boundaries between the associations are difficult to delineate. Drawdown vegetation for ponds 3, 27, 47, 50 and 65 could not be classified confidently in the associations described below.

Eleocharis palustris/Juncus alpinus Association. In areas near the mountains, many ponds with stony or occasionally mud substrates support relatively sparse drawdown vegetation dominated by common spikerush (Eleocharis palustris), northern rush (Juncus alpinus), silverweed (Potentilla anserina) and green

sedge (Carex oederi). Field mint (Mentha arvensis), water smartweed (Polygonum amphibium) and needle spikerush (Eleocharis acicularis) are common associated species. This association occurs around permanent ponds with fresh to slightly brackish waters. Conductivity measurements ranged from 215 to 1,270 uhmos/cm with a median of 695 uhmos/cm. This community is common in the Blacktail Bench and Flatiron Bench areas. (Ponds 11,12,13,15,16,18,26,38,39,40,41,42)

Eleocharis palustris/Mentha arvensis Association. Drawdown vegetation dominated by common spikerush, field mint and silverweed is common in the western part of the study area. Common associated species include needle spikerush, water smartweed and creeping buttercup (Ranunculus flammula). Introduced grasses, Kentucky bluegrass (Poa pratensis) and water bluegrass (P. palustris) are also common. This association occurs around permanent ponds with fresh to moderately brackish waters and mud, organic or stony substrates. Conductivity measurements ranged from 245 to 2,970 uhmos/cm with a median of 460 uhmos/cm. This association is common in the Duck Lake area. It is similar to the preceding association but lacks northern rush and green sedge and is not confined to stony substrates. (Ponds 12,14,19,43,68,68,71,72,76,82,83)

Eleocharis palustris/Hordeum jubatum Association. This community is dominated by squirreltail barley (Hordeum jubatum) and common spikerush. Other common species include silverweed and needle spikerush. This association occurs in temporary ponds and around permanent ponds with slightly to moderately brackish waters and mud substrates. Conductivity measurements ranged from 635 to 2,710 uhmos/cm with a median of 1,020 uhmos/cm. This association occurs throughout the study area but is most common in the East Glacier area. (Ponds 1,4,5,8,31,42,51,52,58)

Eleocharis palustris/Chenopodium glaucum Association. This minor association occurs in the centers of temporary ponds with mud substrates. Common spikerush and glaucus goosefoot (Chenopodium glaucum) form relatively dense stands. Water smartweed, arrowgrass (Triglochin matitimum) and red goosefoot (Chenopodium rubrum) are associated species. Many of these species are indicators of high salinity. (Ponds 2,25,31)

Hordeum jubatum/Puccinellia spp. Association. This type is dominated by the halophytic grasses squirreltail barley, alkaligrass (Puccinellia spp.) and inland saltgrass (Distichlis stricta). Common associated species include silverweed, American bulrush (Scirpus americanus), alkali aster (Aster brachyactis) and shore buttercup (Ranunculus cymbalaria). Glasswort (Salicornia rubra) is a codominant in some stands. The low shrub Sueda depressa was common around one pond in the Willow Creek area. This association occurs mainly around permanent ponds with slightly brackish to saline waters and mud or stony mud

substrates. Conductivity measurements ranged from 435 to 43,870 uhmos/cm with a median of 7,115 uhmos/cm. This association is common throughout most of the study area. (Ponds 2,6,9,20,21,28,29,30,32,33,34,44,46,48,49,53,54, 59,61,62,79)

Distichlis stricta/Puccinellia spp. Association. This association is similar to the preceding but lacks squirreltail barley as a dominant. One or both of the halophytic grasses, inland saltgrass and alkaligrass are dominant. Common associated species include silverweed, American bulrush and glaucus goosefoot. Glasswort is a codominant in some stands. Ponds supporting this association generally have slightly brackish to brackish waters and mud substrates. Conductivity measurements ranged from 400 to 20,115 uhmos/cm with a median of 1,970 uhmos/cm. This association occurs throughout the study area. (Ponds 1,9,10,22,23,24,32,43,47,49,53)

Meadow Zone

Meadow vegetation dominated by graminoids usually forms the outermost zone of wetland vegetation around the ponds in the study area. This zone is usually not flooded but has a higher water table than surrounding grasslands due to the presence of the pond depression. Species common in the drawdown zone are often present in the meadow zone as well. Salinity of the water and soil in the pond basin appears to have some effect on the character of the vegetation; however, because this is the driest wetland zone, it is probably less affected than the more hydric zones. Meadows are the only wetland communities associated with prairie ponds that appear to have suffered permanent degradation from livestock grazing. Meadow vegetation around ponds 70 and 77 was composed entirely of exotics. The meadow around pond 44 could not be classified in the associations described below.

Deschampsia cespitosa/Juncus balticus Plant Association. This is the common meadow community found bordering ponds in the study area. It is dominated by tufted hairgrass (Deschampsia cespitosa), Baltic rush (Juncus balticus) and silverweed (Potentilla anserina). Other common graminoids include clustered field sedge (Carex praegracilis), bearded wheatgrass (Agropyron caninum), alkali bluegrass (P. juncifolia), and the introduced Kentucky bluegrass (Poa pratensis), water bluegrass (P. palustris) and redtop (Agrostis alba). Common forbs are white prairie aster (Aster pansus), curly-cup gumweed (Grindelia squarrosa), rosy pussytoes (Antennaria microphylla) and western blueflag (Iris missouriensis). Composition of this plant association is variable, probably due to differences in soil characteristics and grazing history. Heavy livestock use probably causes a decrease in tufted hairgrass and an increase in Baltic rush and the forb component. Many stands lacked any

appreciable quantity of tufted hairgrass but were otherwise similar in composition to stands in which it was present. Associated pond waters are slightly brackish to saline. Conductivity measurements ranged from 150 to 42,800 uhmos/cm with a median of 960 uhmos/cm.
(Ponds 4,5,7,8,9,11,12,14,19,20,21,22,24,26,27,28,30,31,32,33,36, 38,40,43,45,46,48,49,50,51,53,54,55,56,57,58,59,60,61,62,63,64, 65,66,68,75,79,81,84).

Deschampsia cespitosa/Carex lanuginosa Plant Association. This community is dominated by tufted hairgrass and wooly sedge (Carex lanuginosa). Baltic rush and clustered field sedge are other common graminoids. Common forbs are field mint (Mentha arvensis) and silverweed. Associated pond waters are fresh to slightly brackish. Conductivity measurements ranged from 230 to 1,020 uhmos/cm with a median of 270 uhmos/cm. This plant association is confined to ponds relatively close to the mountains and is most common in the Blacktail Bench area. (Ponds 15,16,17,37,42).

Description of Individual Wetland-Prairie Complexes

The eight prairie-wetland complexes surveyed differ in soils, topography and climate, resulting in differences in the wetland vegetation. No single complex contains all of the plant associations described above (Table 1). Following is a description of each complex including a brief description of the associated grasslands and the wetland diversity present.

Flatiron Bench. This area is at the eastern edge of the foothills of the Front Range 5 miles west-southwest of Browning. The pond complex covers an area of ca. 1800 acres. Elevations range from 4800 to 4900 ft. Ponds are ca. 5-20 acres in size. Adjacent grasslands are dominated by rough fescue (Festuca scabrella), Idaho fescue (Festuca idahoensis), and Parry's oatgrass (Danthonia parryi). Common forbs are northern bedstraw (Galium boreale) and sticky crazyweed (Oxytropis viscida). There are small groves of aspen (Populus tremuloides) adjacent to some of the ponds. Grasslands in upland topographic positions appeared to be in good condition. The introduced grass timothy (Phleum pratense) is common in many of the swales and occasionally in meadows around the ponds. Canada thistle (Cirsium arvense) is common in the wet meadow zone around some of the ponds. Conductivity values for pond water ranged from 320 to 1,660 uhmos/cm. Most of the wetland plant associations common around ponds with fresh to slightly brackish water are represented in this area (Table 1), but the ponds are too small and too few to provide a good representation of wetland plant community diversity.

East Glacier. This prairie-wetland complex is on the plains

Table 1. Representation of wetland plant associations in the eight prairie-wetland complexes in the study area. Range of conductivity measurements (umos/cm) are given below the name of each area. Median conductivity values of pond water for each plant association appear in parentheses beneath the association acronym. Refer to the text for full names of the associations.

	Duck Lake 150-550	Flatiron Bench 320-1660	East Glacier 265-20115	Blacktail Bench 230-1275	Willow Creek 265-11610	Reagan Camp 155-15710	Two Medicine 2300-43870	Badger Creek 1240-12625
Open Water								
Pori/Mysp (460)	5	4	1	6	-	1	1	1
Pope/Mysp (2,500)	2	-	6	1	1	-	2	1
Zapa (3,745)	-	-	-	-	4	1	-	-
Rume/Pope (7,700)	-	-	-	-	-	-	1	5
Marsh								
Glho/Elpa (355)	13	3	-	2	-	-	-	-
Care/Elpa (415)	9	2	3	-	-	-	-	-
Elpa/Elac (435)	4	1	5	1	1	4	-	-
Cast/Elpa (535)	2	-	-	-	8	-	1	-
Scac (780)	2	3	4	4	7	-	-	4
Deciduous								
Elpa/Mear (450)	7	1	-	2	-	-	-	1
Elpa/Qual (460)	-	5	-	6	-	-	-	1
Elpa/Hoju (1,020)	-	1	4	-	1	2	1	-
Dist/Rucc (1,970)	-	1	3	-	1	2	1	3
Hoju/Rucc (7,115)	1	-	3	-	5	4	6	2
Elpa/Orgl (dry)	-	-	1	-	-	-	1	1
Meadow								
Dece/Cala (270)	-	1	1	3	-	-	-	-
Dece/Juba (960)	5	3	6	3	14	6	5	7
TOTAL	50	25	37	28	42	20	19	26

approximately 7 miles east-northeast of East Glacier. It covers an area of approximately 6500 acres. Elevations range from 4500 to 5000 ft. Ponds are ca. 5-100 acres in size. Adjacent grasslands are dominated by rough fescue, Idaho fescue and Parry's oatgrass. Common forbs are sticky geranium (Geranium viscosissimum), silky lupine (Lupinus sericeus) and northern bedstraw. Grasslands are generally in good to excellent condition. Conductivity values for pond waters ranged from 265 to 20,115 uhmos/cm. The East Glacier area has a good representation of pond-associated plant communities (Table 2). There are numerous ponds of varying size, depth and salinity.

Two Medicine. This area is on the plains approximately 9 miles southeast of East Glacier and covers an area of approximately 2500 acres. Elevations range from 4500 to 4600 ft. Ponds are ca. 5-20 acres in size. Grasslands on ridgetops and warmer slopes are dominated by needle-and-thread (Stipa comata), thick-spiked wheatgrass (Agropyron dasystachyum) and junegrass (Koeleria cristata). Common forbs include fringed sagewort (Artemisia frigida), broom snakeweed (Gutierrezia sarothrae) and whitlow-wort (Paronychia sessiliflora). Slopes with cooler aspects are dominated by rough fescue, Idaho fescue and silky lupine. The high coverage of forbs indicates that the grasslands have suffered degradation from livestock grazing. Conductivity values for pond waters ranged from 2,300 to 43,870 uhmos/cm. This area has a poor representation of wetland plant associations (Table 1). Only communities associated with more saline ponds are well represented.

Badger Creek. This complex is on the plains approximately 7 miles northwest of the town of Heart Butte. It covers an area of approximately 3500 acres. Elevations range from 4400 to 4550 ft. Ponds are ca. 5-80 acres in size. Grasslands are dominated by rough fescue, Idaho fescue, thick-spiked wheatgrass and Parry's oatgrass. Common forbs are fringed sagewort and silvery lupine (Lupinus argenteus). The grasslands are in poor to fair condition. Conductivity values for pond waters ranged from 1,240 to 16,625 uhmos/cm. This area has a good representation of wetland communities usually associated with more saline ponds, but fresh water communities are poorly represented (Table 1).

Blacktail Bench. This area lies between the two forks of Blacktail Creek at the base of the foothills of the Front Range 18 miles west-northwest of Dupuyer. It covers an area of approximately 2500 acres. Elevations range from 4750 to 4900 ft. Ponds are ca. 5-40 acres in size. The Blacktail Bench area is situated in the aspen parkland zone; stands of aspen are interspersed with the ponds and grasslands. Grasslands are dominated by rough fescue, Idaho fescue, Parry's oatgrass and silky lupine. They are in fair to good condition; however, the exotics Canada thistle and timothy are locally common. Conductivity values for pond waters ranged from 230 to 1,275

uhmos/cm. This area has a fair representation of wetland plant associations (Table 1). Blacktail Bench has typical glaciated pothole ponds occurring in aspen parkland. This wetland-deciduous forest-grassland mosaic is probably common in Canada but is uncommon in the glaciated plains region of the United States. The Blacktail Bench area is one of the two best examples of this ecosystem that I have seen in Montana.

Reagan Camp. This prairie-wetland complex is found on the plains just east of the Milk River and south of the Canadian Border. It covers an area of approximately 1800 acres, and elevations range from 3950 to 4150 ft. Ponds are 5-30 acres in area, and conductivity values ranged from 155 to 15710 uhmos/cm. Mesic mid-grass prairie in the area is dominated by thick-spike wheatgrass (Agropyron dasystachyum), junegrass (Koeleria cristata) and Idaho fescue. Common forbs are mugwort (Artemisia ludoviciana), fringed sagewort and golden pea (Thermopsis rhombifolia). Drier sites are dominated by blue grama (Bouteloua gracilis), needle-and-thread (Stipa comata), thick-spike wheatgrass and fringed sagewort. Grasslands are in fair to good condition; however, much of the area has been plowed. The Reagan Camp area is an active oil field with numerous roads and wells. Most of the ponds are small. Marsh and fresh water drawdown associations are poorly represented (Table 1).

Willow Creek. This area lies approximately 15 miles east of the mountains between the St. Mary River and the North Fork of the Milk River just south of the Canadian Border. It covers an area of approximately 3,000 acres with elevation ranging from 4250 to 4400 ft. Ponds are 5-40 acres in area, and conductivity of pond waters ranged from 265 to 11610 uhmos/cm. Foothills prairie dominated by rough fescue, Idaho fescue, western needlegrass and junegrass occupies the mesic sites. Common forbs include silky lupine, northern bedstraw (Galium boreale) and sticky geranium (Geranium viscosissimum). Drier sites are dominated by thick-spike wheatgrass, Idaho fescue, needle-and-thread and Sandberg's bluegrass (Poa sandbergii) with fringed sagewort and golden pea. Grasslands are in fair condition, often with a high cover of forbs, and much of the area has been plowed and planted to smooth brome (Bromus inermis) and timothy (Phleum pratense). Where plowing has occurred adjacent to ponds, the meadow and drawdown zones have been invaded by Canada thistle and sow thistle (Sonchus spp.). Most marsh and drawdown associations are poorly represented (Table 1).

Duck Lake. This large wetland-prairie-forest complex is found 3 miles east of Babb and the St. Mary River at an elevation of 5100 to 5200 ft. The complex covers an area of approximately 8000 acres, not including Duck Lake itself. Ponds are 5-80 acres in area with Duck Lake and Goose Lake approximately 1300 and 300 acres respectively. Ponds have relatively fresh water with conductivity ranging from 150 to 550 uhmos/cm. The area is a

mosaic of mesic aspen forests, wetlands and foothills prairie. In much of the area both forests and grasslands have been degraded by livestock grazing. In the eastern part of the area that is predominantly grassland, grazing has been less intense, and extensive stands dominated by rough fescue, Idaho fescue, timber oatgrass (Danthonia intermedia) and western needlegrass remain in good to excellent condition. Many of the meadow communities adjacent to ponds in the aspen parkland have been invaded by exotics such as Canada thistle, sow thistle and Kentucky bluegrass. Although fresh water marsh associations are well represented, there is only one common drawdown community found in the area (Table 1).

The Flora

We recorded 173 species of vascular plants associated with pothole ponds in the study area (Appendix B). Twelve of these are introduced species. The remaining 161 are relatively widespread native species usually associated with wetlands throughout their range. Representation of the wetland flora in the eight prairie-wetland complexes is presented in Appendix B.

Three species of wetland vascular plants found in the study area are considered rare in Montana (Lesica et al. 1984, MNHP 1989). Maps showing exact locations for these species in the study area are on file at the Montana Natural Heritage Program, Helena.

Carex crawei Dewey. Craw's sedge occurs from Newfoundland to southern British Columbia, south to Alabama, Kansas, Washington, Wyoming and Utah but is considered rare in the western U.S. (Hitchcock et al. 1969). It is listed as rare in Alberta (Packer and Bradley 1984) and British Columbia (Straley et al. 1985). In Montana, Craw's sedge is known from two small populations in Teton County (Lesica et al 1984) and is reported for Beaverhead County (Hitchcock et al. 1969). It is often associated with areas of calcareous parent material (Hermann 1970). Craw's sedge is listed as state endangered (G5-S1) by the Montana Natural Heritage Program.

In the study area, Craw's sedge occurs in the narrow ecotone between meadow and drawdown zones around at least six ponds in the Blacktail Bench area. The number of individuals is estimated to be at least 1,000. This population is the largest known in Montana; it does not appear to be threatened at the present time.

Carex sychnocephala Carey. Many-headed sedge occurs from Ontario to British Columbia, south to New York, South Dakota, Montana and Washington, but it is considered rare in western North America (Hitchcock et al. 1969). It is listed as rare in British Columbia, Michigan and Wisconsin (Straley et al. 1985) and sensitive in Washington (Washington Natural Heritage Program

1987). In Montana, many-headed sedge is known from one station each in Sheridan, Flathead and Lincoln counties. The latter two populations are threatened by residential development. Many-headed sedge is listed as state endangered (G4-S1) by the Montana Natural Heritage Program.

In the study area, many-headed sedge was found in the drawdown zone of a single pond in the Flatiron Bench area (T32N R12W S15 SW1/4 of SE1/4) and in the drawdown zone of a pond in the Duck Lake area (T36N R14W S13 NE1/4). The number of individuals at the Flatiron Bench site is estimated to be 500 and does not appear to be threatened at the present time. The Duck Lake population is also estimated to be 500 plants, many of which were heavily grazed in 1989.

Elodea longivaginata St. John. Long-sheath waterweed is found in the Great Plains from southern Saskatchewan and Alberta south to New Mexico. It is considered rare in Canada (Catling and Wojtas 1986). In Montana E. longivaginata is known from fewer than five sites in the north-central part of the state. It is listed as state endangered by the Montana Natural Heritage Program (G?-S1).

In the study area, long-sheathed waterweed was found in a single pond in the Reagan Camp area (T37N R7W S9 SE1/4). I estimated that the population consisted of at least 1,000 individuals. This population is threatened by contamination from the oil and gas extraction and by eutrophication from agricultural fertilizers.

CONCLUSIONS

The glaciated prairie pothole complexes found in the southwestern part of the Blackfeet Indian Reservation have a rich flora and a high diversity of plant associations. The biological diversity of the wetlands surveyed is probably higher than in any other glaciated prairie pothole region east of the Continental Divide in Montana. Furthermore, The Blackfeet Reservation may contain the largest areas of undegraded prairie-wetland ecosystem remaining in the Northern Great Plains of the United States. Although numerous pragmatic considerations must be taken into account in implementing any conservation strategy, it is hoped that the following biological assessment will prove useful in future protection planning.

A desirable system of reserves would protect high quality areas of prairie-wetland that fully represent the range of biological diversity present on the Blackfeet Reservation. Tabulation of plant associations in the eight prairie-wetland areas sampled (Table 1) shows that no single area contains all of the plant associations present in the entire study area. The eight prairie-wetland areas can be divided into two groups: (1) aspen parkland complexes (Duck Lake, Flatiron Bench, Blacktail Bench)

characterized by higher elevations, relatively fresh water and the presence of aspen groves and (2) plains complexes (Willow Creek, Reagan Camp, Two Medicine, Badger Creek) at lower elevations lacking forests with saline waters in at least some ponds (Table 2). East Glacier appears to be intermediate with some characteristics of both groups. Wetland plant associations confined to ponds with brackish or saline waters are found only on the plains, while communities associated with fresh waters or more mesic climatic conditions occur only in the aspen parkland areas. In general, aspen parkland areas (including East Glacier) have higher species richness and higher diversity and evenness of wetland plant associations (Table 2).

Due to its intermediate position on the aspen parkland-plains gradient, high species richness, community diversity, large size and good condition grasslands, the East Glacier area would be the best choice for a single reserve. However, a system of reserves could capture more of the diversity present in the study area. The Blackfeet Reservation has the only examples of aspen parkland-glacial wetland ecosystem in the United States. From landscape, community and species perspectives, the aspen parkland areas are very diverse. One of these areas should be protected. Although Flatiron Bench has high community diversity, it is a small area with only small ponds. Either the Duck Lake or Blacktail Bench area would be a better choice for a reserve. Due to their relatively high species and community diversity, the East Glacier and Badger Creek areas would be the best choices for a reserve to represent the plains area. Of these two, East Glacier has better condition grasslands; however, they are more mesic with composition more similar to foothills prairie than grasslands typical of the plains areas.

Although careful management of all wetlands is desirable, certain areas may be judged more critical for conserving biological diversity than others. A reserve system including the East Glacier, Badger Creek and Duck Lake or Blacktail Bench areas would protect examples of most wetland communities and should therefore conserve a large portion of the biological diversity contained in the prairie-wetland ecosystems of the Blackfeet Reservation.

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Table 2. Summary of geographic characteristics and measures of wetland biological diversity for prairie-wetland complexes on the Blackfeet Indian Reservation. Shannon's Index of Diversity (H') and Index of Evenness (E) were calculated for plant associations following methods outlined in Magurran (1988).

	Dick Lake	Flatiron Bench	East Glacier	Blacktail Bench	Willow Creek	Reagan Camp	Two Medicine	Badger Creek
# ponds sampled	17	6	13	8	15	9	7	9
Land area (acres)	8000	1800	6600	2500	3000	1800	2500	3500
Elevation (ft.)	5150	4850	4750	4825	4325	4080	4550	4475
Conductivity range (umos/cm)	150-550	320-1660	265-20115	220-1275	265-11610	155-15710	2300-43870	1240-12625
# of native species	74	66	67	83	43	43	—	62
# of plant associations	10	11	11	9	9	7	9	10
Associations/pond	2.9	4.2	2.8	3.5	2.8	2.2	2.7	2.9
Shannon's H'	2.05	2.22	2.25	2.03	1.81	1.77	1.88	2.03
Shannon's E	.895	.926	.937	.925	.826	.907	.857	.881

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Appendix A. Location and specific conductance of water for ponds in the study area.

Pond #	Location	Conductivity (uhmos/cm)
	Flatiron Bench	
38	T32N R12W S15 SE1/4	1090
39	T32N R12W S15 SE1/4	375
40	T32N R12W S22 NW1/4	450
41	T32N R12W S15 SW1/4	320
42	T32N R12W S15 SW1/4	1015
43	T32N R12W S15 NE1/4	1660
	East Glacier	
1	T32N R11W S10 NW1/4	dry
2	T32N R11W S16 NE1/4	dry
3	T32N R11W S17 SE1/4	5565
4	T31N R12W S3 SE1/4	dry
5	T31N R12W S11 NW1/4	dry
6	T31N R12W S2 SW1/4	dry
7	T31N R12W S2 NW1/4	dry
8	T31N R11W S4 SW1/4	dry
9	T31N R11W S4 NW1/4	20,115
10	T31N R11W S5 NW1/4	1970
35	T31N R12W S3 SE1/4	2,505
36	T31N R12W S2 NW1/4	800
37	T32N R12W S35 NE1/4	265
	Two Medicine	
28	T30N R11W S11 SW1/4	5,565
29	T30N R11W S2 NW1/4	43,870
30	T31N R11W S34 SE1/4	42,800
31	T31N R11W S34 SE1/4	dry
32	T31N R11W S34 SW1/4	dry
33	T31N R11W S33 SE1/4	22,365
34	T30N R11W S4 NE1/4	2,300
	Badger Creek	
19	T30N R10W S22 NE1/4	2,975
20	T30N R10W S21 NE1/4	12,625
21	T30N R10W S20 NW1/4	8,665
22	T30N R10W S19 NE1/4	3,125
23	T30N R10W S19 NE1/4	2,035
24	T30N R10W S19 SE1/4	6,740
25	T30N R10W S21 SW1/4	dry
26	T30N R10W S20 SE1/4	1,240
27	T30N R10W S20 SE1/4	3,190
	Blacktail Bench	
11	T29N R10W S36 NE1/4	655
12	T29N R10W S36 SE1/4	910
13	T29N R10W S36 SE1/4	1,275
14	T28N R10W S1 SW1/4	535
15	T28N R10W S1 SW1/4	290
16	T28N R10W S12 NW1/4	230
17	T28N R10W S2 SE1/4	460
18	T29N R10W S35 SE1/4	740

		Reagan Camp	
44	T37N R7W S15	SW1/4	3,785
45	T37N R7W S9	SE1/4	375
46	T37N R7W S9	SW1/4	875
47	T37N R7W S9	SW1/4	390
48	T37N R7W S9	SW1/4	625
49	T37N R7W S8	SE1/4	15,710
50	T37N R7W S4	NE1/4	155
51	T37N R7W S4	NW1/4	dry
52	T37N R7W S3	SE1/4	2,705
		Willow Creek	
53	T37N R12W S17	NW1/4	780
54	T37N R12W S17	NW1/4	3,745
55	T37N R12W S17	NE1/4	5,245
56	T37N R12W S16	NW1/4	290
57	T37N R12W S9	SW1/4	580
58	T37N R12W S9	SW1/4	635
59	T37N R12W S8	NE1/4	11,610
60	T37N R12W S8	NE1/4	945
61	T37N R12W S9	NW1/4	970
62	T37N R12W S9	NW1/4	1,685
63	T37N R12W S9	NW1/4	1,120
64	T37N R12W S9	NE1/4	1,865
65	T37N R12W S10	NW1/4	265
66	T37N R12W S10	SW1/4	585
67	T37N R12W S9	SW1/4	330
		Duck Lake	
68	T36N R13W S23	SW1/4	315
69	T36N R13W S23	NW1/4	365
70	T36N R13W S15	SE1/4	235
71	T36N R13W S21	SE1/4	245
72	T36N R13W S19	SW1/4	460
73	T36N R13W S19	SW1/4	395
74	T36N R13W S18	SW1/4	435
75	T36N R14W S13	NE1/4	355
76	T36N R14W S13	NW1/4	550
77	T36N R14W S13	NW1/4	355
78	T36N R14W S12	SW1/4	220
79	T36N R14W S12	NW1/4	435
80	T36N R13W S7	SE1/4	425
81	T36N R13W S16	NW1/4	215
82	T36N R13W S9	SW1/4	255
83	T36N R13W S10	NW1/4	245
84	T36N R13W S10	NW1/4	150

Appendix B. Vascular plant species associated with glaciated pothole wetlands on the Blackfeet Indian Reservation, Montana. Nomenclature follows Hitchcock and Cronquist (1973). An asterisk (*) indicates an introduced species. The study sites are Duck Lake (DL), Willow Creek (WC), Flatiron Bench (FB), Reagan Camp (RC), East Glacier (EG), Two Medicine (TM), Badger Creek (BC) and Blacktail Bench (BT).

	DL	WC	FB	RC	EG	TM	BC	BT
Alismataceae								
Alisma plantago-aquatica								x
Sagittaria cuneata	x	x	x			x	x	x
Apiaceae								
Cicuta douglasii	x	x						
Sium suave	x	x	x		x	x		x
Zizia aptera		x			x			
Asteraceae								
Arnica chamissonis	x		x					
Artemisia ludoviciana	x			x		x	x	
Aster brachyactis		x	x		x	x	x	x
Aster junciformis				x				
Aster occidentalis		x	x		x			
Aster pansus		x		x		x	x	x
Cirsium arvense*	x	x	x	x	x	x	x	x
Crepis runcinata	x	x	x		x		x	
Erigeron lonchophyllus			x		x		x	x
Grindelia squarrosa		x		x	x	x	x	x
Haplopappus integrifolius		x	x	x	x	x		x
Haplopappus uniflorus	x							
Iva axillaris					x			
Petasites sagittatus	x							
Senecio pauperculus	x							x
Sonchus asper*							x	x
Sonchus uliginosus*		x	x	x				
Taraxacum officinale*	x	x	x		x		x	x
Betulaceae								
Betula glandulosa								x
Boraginaceae								
Plagiobothrys scouleri	x			x				
Brassicaceae								
Lepidium sp.				x	x		x	
Rorippa islandica	x		x		x			x
Rorippa obtusa				x				
Rorippa sinuata (?)	x						x	

	DL	WC	FB	RC	EG	TM	BC	BT
Callitrichaceae								
Callitriche sp.	x	x		x				x
Caryophyllaceae								
Stellaria longifolia	x	x		x				
Chenopodiaceae								
Chenopodium album*		x						
Chenopodium glaucum		x	x	x	x	x	x	x
Chenopodium rubrum					x	x		
Monolepis nuttalliana				x				
Salicornia rubra		x		x	x	x		
Sueda depressa		x						
Crassulaceae								
Tillaea aquatica				x				
Cyperaceae								
Carex aquatilis			x		x			
Carex arcta					x	x		x
Carex atherodes	x	x		x	x	x		
Carex athrostachya	x							
Carex aurea	x		x		x			x
Carex buxbaumii								x
Carex crawei								x
Carex lanuginosa		x	x		x		x	x
Carex microptera	x							
Carex nebrascensis			x					x
Carex oederi			x					x
Carex parryana							x	
Carex praegracilis	x	x	x		x	x	x	x
Carex rostrata	x		x		x			x
Carex scirpoidea							x	x
Carex sychnocephala	x		x					
Carex vesicaria	x							
Eleocharis acicularis	x	x	x	x	x	x	x	x
Eleocharis palustris	x	x	x	x	x	x	x	x
Eleocharis pauciflora								x
Scirpus acutus	x	x	x		x		x	x
Scirpus americanus		x		x	x	x	x	
Scirpus maritimus				x		x		
Scirpus onleyi				x		x		
Scirpus validus								x
Elaeagnaceae								
Elaeagnus commutata							x	
Elatinaceae								
Elatine triandra		x		x				

	DL	WC	FB	RC	EG	TM	BC	BT
Equisetaceae								
Equisetum arvense	x							
Equisetum fluviatile	x							x
Equisetum laevigatum			x					
Equisetum variegatum					x			x
Fabaceae								
Astragalus agrestis					x			
Astragalus bisulcatus					x			
Glycyrrhiza lepidota						x		
Gentianaceae								
Gentiana amarella			x				x	
Haloragaceae								
Myriophyllum spicatum	x	x	x	x	x	x	x	x
Hippuridaceae								
Hippuris vulgaris	x		x		x	x	x	x
Hydrocharitaceae								
Elodea longivaginata				x				
Isoetaceae								
Isoetes bolanderi	x							
Iridaceae								
Iris missouriensis			x		x		x	x
Sisyrinchium angustifolium	x						x	x
Juncaceae								
Juncus alpinus	x		x		x	x	x	x
Juncus balticus	x	x	x	x	x	x	x	x
Juncus bufonius					x		x	x
Juncus ensifolius	x							
Juncus longistylis	x		x		x		x	x
Juncus nodosus			x					x
Juncus tenuis	x							x
Juncus torreyi							x	
Juncaginaceae								
Triglochin maritimum		x	x		x		x	x
Triglochin palustre			x					x
Lamiaceae								
Lycopus sp.	x							
Mentha arvensis	x	x	x	x	x		x	x
Stachys palustris	x	x	x	x	x		x	x
Lentibulariaceae								
Utricularia vulgaris	x		x		x		x	x

	DL	WC	FB	RC	EG	TM	BC	BT
Liliaceae								
Allium schoenoprasum								x
Zigadenus elegans	x							x
Onagraceae								
Epilobium alpinum							x	
Epilobium glaberrimum			x		x			x
Epilobium watsonii	x							
Epilobium sp.							x	
Orchidaceae								
Spiranthes romanzoffiana								x
Plantaginaceae								
Plantago eriopoda			x			x		
Plantago major*							x	x
Poaceae								
Agropyron caninum			x			x	x	x
Agropyron smithii				x				
Agrostis alba*					x		x	x
Agrostis scabra			x	x	x		x	
Alopecurus aequalis	x	x		x	x		x	x
Alopecurus alpinus	x				x			
Alopecurus pratensis*		x		x				
Beckmannia syzigachne		x	x	x	x			x
Calamagrostis canadensis			x					x
Calamagrostis inexpansa		x			x	x	x	x
Deschampsia cespitosa	x	x	x	x	x	x	x	x
Distichlis stricta		x	x	x	x	x	x	
Glyceria borealis	x		x					x
Glyceria grandis	x	x						x
Glyceria striata								x
Hierochloe odorata					x			
Hordeum brachyantherum			x				x	
Hordeum jubatum	x	x	x	x	x	x	x	x
Muhlenbergia richardsonis			x			x		
Panicum capillare							x	x
Phalaris arundinacea*	x	x						
Poa arida				x				
Poa compressa*						x		
Poa juncifolia					x		x	
Poa palustris*	x	x		x	x			
Poa pratensis*	x	x	x	x	x	x	x	x
Puccinellia distans/nuttalliana	x	x	x	x	x	x	x	x
Spartina gracilis			x		x		x	
Sphenopholis obtusata			x					
Polygonaceae								
Polygonum aviculare				x	x		x	x
Polygonum polygaloides			x					
Polygonum amphibium	x	x	x	x	x	x	x	x

	DL	WC	FB	RC	EG	TM	BC	BT
Polygonum lapathifolium*							x	x
Rumex crispus*	x	x	x					
Rumex maritimus					x			x
Rumex salicifolius	x			x				
Potamogetonaceae								
Potamogeton gramineus	x	x	x		x			x
Potamogeton pectinatus	x	x	x		x	x	x	x
Potamogeton pusillus	x							
Potamogeton richardsonii	x	x	x	x	x	x		x
Primulaceae								
Dodecatheon pulchellum	x	x			x		x	x
Glaux maritima				x	x	x	x	
Ranunculaceae								
Myosurus aristatus				x				
Ranunculus aquatilis	x	x	x	x	x		x	x
Ranunculus cymbalaria				x	x	x	x	x
Ranunculus flammula	x		x		x		x	x
Ranunculus gmelinii	x							x
Ranunculus macounii	x		x					x
Ranunculus uncinatus	x							
Rosaceae								
Geum macrophyllum	x							
Potentilla anserina	x	x	x	x	x	x	x	x
Potentilla fruticosa			x				x	x
Potentilla paradoxa	x			x			x	x
Rubiaceae								
Galium trifidum	x							
Ruppiaceae								
Ruppia maritima						x	x	x
Salicaceae								
Salix bebbiana	x		x					
Salix candida			x					x
Salix sp.					x			x
Populus tremuloides	x		x					x
Populus trichocarpa	x		x					
Saxifragaceae								
Parnassia palustris			x					
Scrophulariaceae								
Castilleja miniata	x							x
Limosella aquatica				x				
Pedicularis groenlandica			x		x			
Veronica americana	x							

	DL	WC	FB	RC	EG	TM	BC	BT
Veronica scutellata	x							
Veronica peregrina	x	x		x			x	
Sparganiaceae								
Sparganium emersum	x							x
Typhaceae								
Typha latifolia	x	x						
Violaceae								
Viola nephrophylla			x				x	x
Zanichelliaceae								
Zanichellia palustris		x		x				
TOTAL SPECIES	80	55	71	53	71	--	68	89

Appendix C. Maps showing location of ponds sampled. The name of the prairie-wetland complex is followed by the name of the USGS quad map.